OBSERVATIONS & RECOMMENDATIONS

After reviewing data collected from **LAUREL LAKE** the program coordinators recommend the following actions.

FIGURE INTERPRETATION

- Figure 1: These graphs illustrate concentrations of chlorophyll-a in the water column. Algae are microscopic plants that are a natural part of lake ecosystems. Algae contain chlorophyll-a, a pigment necessary for photosynthesis. A measure of chlorophyll-a can indicate the abundance of algae in a lake. The historical data (the bottom graph) show a *stabilizing* in-lake chlorophyll-a trend. Chlorophyll concentrations were elevated in June and July this season. The blue-green alga *Anabaena* was found floating in the lake in June, and can become a nuisance when present in high concentrations. The increase in rain, and the increase in tributary flow this season might have washed excess nutrients into the lake and provided favorable conditions for the alga to grow. While algae are present in all lakes, an excess amount of any type is not welcomed. Concentrations can increase when there are external and internal sources of phosphorus, which is the nutrient algae depend upon for growth. It's important to continue the education process and keep residents aware of the sources of phosphorus and how it influences lake quality.

- Figure 2: Water clarity is measured by using a Secchi disk. Clarity, or transparency, can be influenced by such things as algae, sediments from erosion, and natural colors of the water. The graphs on this page show historical and current year data. The lower graph shows a *stable* trend in lake transparency. Water clarity in June decreased due to the excess amount of algae floating in the lake, and the light rain while viewing the Secchi disk. The clarity proceeded to recover in July and August, and the mean transparency remained above the mean for NH lakes. The 2000 sampling season was considered to be wet and, therefore, average transparency readings are expected to be slightly lower than last year's readings. Higher amounts of rainfall usually cause more eroding of sediments into the lake and streams, thus decreasing clarity.

- Figure 3: These figures show the amounts of phosphorus in the epilimnion (the upper layer in the lake) and the hypolimnion (the lower layer); the inset graphs show current year data. Phosphorus is the limiting nutrient for plants and algae in New Hampshire waters. Too much phosphorus in a lake can lead to increases in plant growth over time. These graphs show a *stabilizing* trend for the upper water layer, and an *improving* trend for the lower water layer. Phosphorus concentrations in June were slightly elevated which could have led to the unwanted blue-green algal growth. Hypolimnetic phosphorus concentrations in August were elevated, and the high result was probably caused by the turbidity of the sample. Contamination of the sample with bottom sediment can lead to high, and inaccurate phosphorus results. One of the most important approaches to reducing phosphorus levels is educating the public. Humans introduce phosphorus to lakes by several means: fertilizing lawns, septic system failures, and detergents containing phosphates are just a few. Keeping the public aware of ways to reduce the input of phosphorus to lakes means less productivity in the lake. Contact the VLAP coordinator for tips on educating your lake residents or for ideas on testing your watershed for phosphorus inputs.

OTHER COMMENTS

- In 2000, small amounts of the blue-green algae *Anabaena* were observed in the lake. Blue-green algae can reach nuisance levels when sufficient nutrients and favorable environmental conditions are present. While overall algae abundance continues to be low in the lake, the presence of these indicator species should serve as a reminder of the lake's delicate balance. Continued care to protect the watershed by limiting or eliminating fertilizer use on lawns, keeping the lake shoreline natural, and properly maintaining septic systems and roads will keep algae populations in balance.

- Tributaries were flowing enough to take samples in the spring this year. Tributaries have not been sampled since 1989 and 1990. We recommended taking these samples to identify possible sources of increased nutrient flow into the lake. We are pleased to report that the conductivity of North Beach Inlet and East Lake Inlet is low and does not indicate any potential pollution problems.

- *E. coli* originates in the intestines of warm-blooded animals (including humans) and is an indicator of associated and potentially harmful pathogens. Bacteria concentrations at the beaches were all below the state standard of 88 counts per 100 mL set for public bathing places. (Table 12). The tributary samples were also below the state standard of 406 counts per 100 mL for Class B waters. If residents are concerned about septic system impacts, testing when the water table is high or after rains is best. Please consult the Other Monitoring Parameters section of the report for the current standards for *E. coli* in surface waters.

- The pH (Table 4) of East Lake Inlet was very low at both sites tested. We suspect that wetland areas located upstream could affect the Inlet. Also the conductivity and *E. coli* results were higher at the 388 E. Lake site compared to the 408 E. Lake site. It would be useful to know which site is the upstream site. If the 388 site is upstream, then the higher *E. coli* and conductivity concentrations are diluted as they approach the lake, which can happen to water flowing from a wetland. However if the 408 site is upstream, then the higher readings are coming from a source closer to the lake. It would be useful to uncover the reasons for the difference between the two sites, and we recommend continued testing of the Inlet when it is flowing in the spring. Also, if you have any useful information as to where the headwaters of the Inlet originate or the watershed surrounding the Inlet please indicate the information on your field data sheet, or call the VLAP Coordinator at 271-2658.

NOTES

- Monitor's Note (6/26/00): Lots of plankton-very thick. Raining while viewing Secchi disk. Lots of algae floating in water.

- Biologist's Note (6/26/00): Algae identified as blue-green *Anabaena.*

- Monitor's Note (7/5/00): 408 E. Lake Road: Logging up hill. 388 E. Lake Road: The homeowner reports the algae have increased dramatically over last 15 years. Greatest at inlet. N. Beach very shallow.

- Monitor's Note (7/17/00): Recent heavy rains.

USEFUL RESOURCES

The Blue Green Algae. North American Lake Management Society, 1989. (608) 233-2836 or www.nalms.org

A Boater's Guide to Cleaner Water, NHDES pamphlet, (603) 271-3503 or www.state.nh.us

Weed Watchers: An Association to Halt the Spread of Exotic Aquatic Plants, WD-BB-4, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Nonpoint Source Pollution and Stormwater Fact Sheet Package. Terrene Institute. (800) 726-5253, or www.terrene.org

Anthropogenic Phosphorus and New Hampshire Waterbodies, NHDES-WSPCD-95-6, NHDES Booklet, (603) 271-3503

The Watershed Guide to Cleaner Rivers, Lakes, and Streams, Connecticut River Joint Commissions, 1995. (603) 826-4800

2000

Bacteria in Surface Waters, WD-BB-14, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

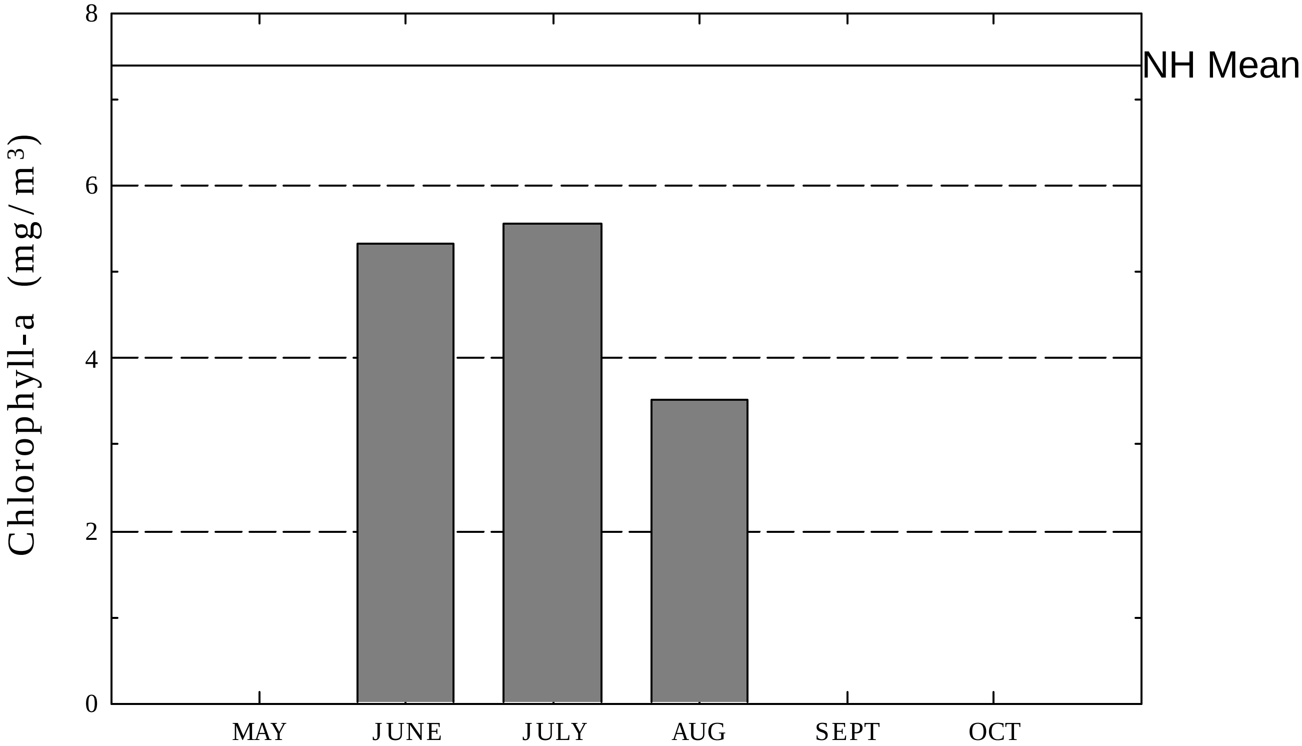
Water Sampling Protocol for E. coli Testing, NHDES Fact Sheet, (603) 271-3503 or www.state.nh.us

Vegetated Phosphorus Buffer Strips, NH Lakes Association pamphlet, (603) 226-0299 or www.nhlakes.org

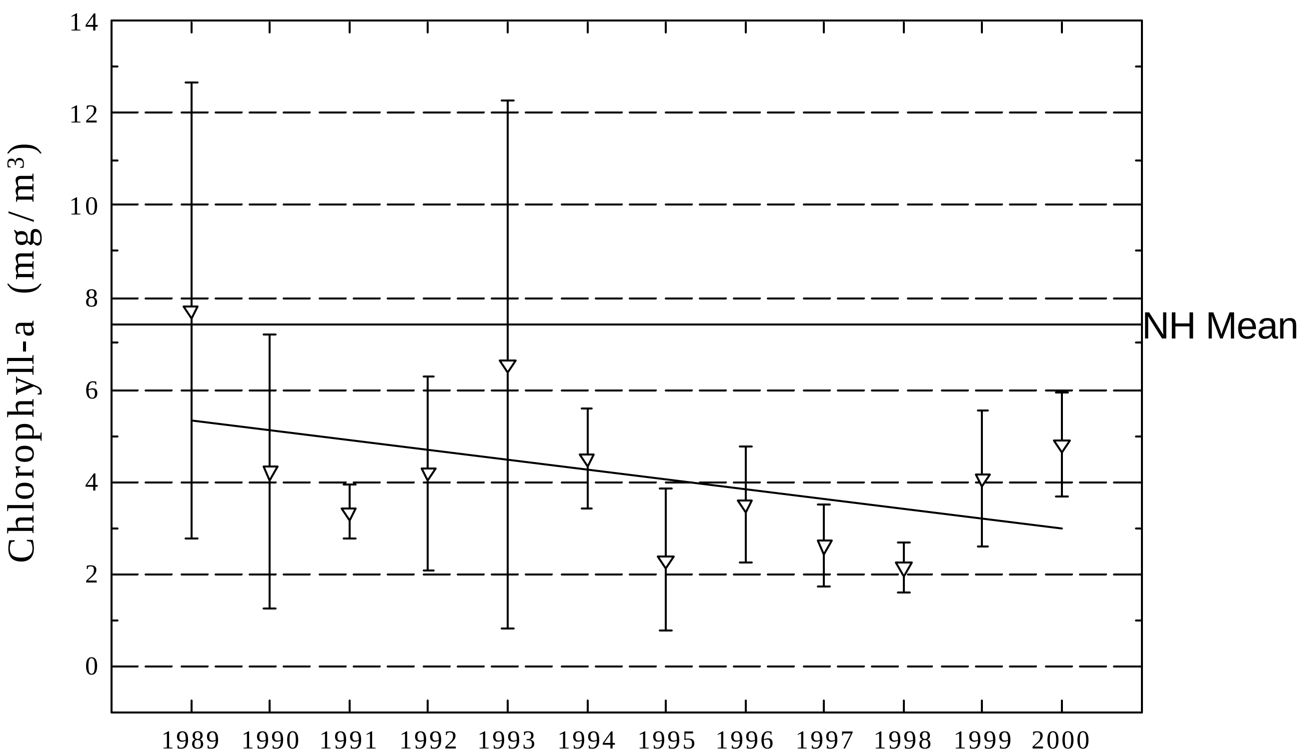
Answers to Common Lake Questions, NHDES-WSPCD-92-12, NHDES Booklet, (603) 271-3503.

Laurel Lake

Figure 1. Monthly and Historical Chlorophyll-a Results



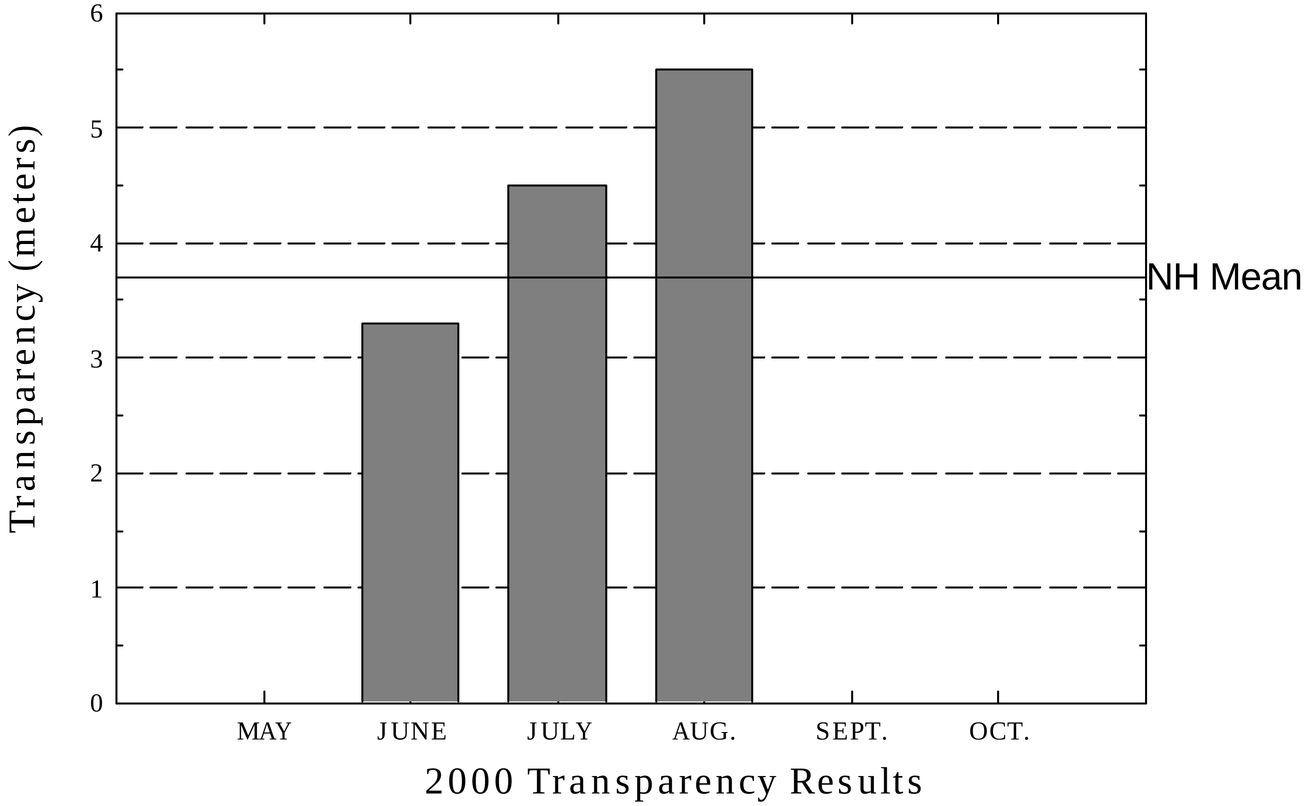
2000 Chlorophyll-a Results

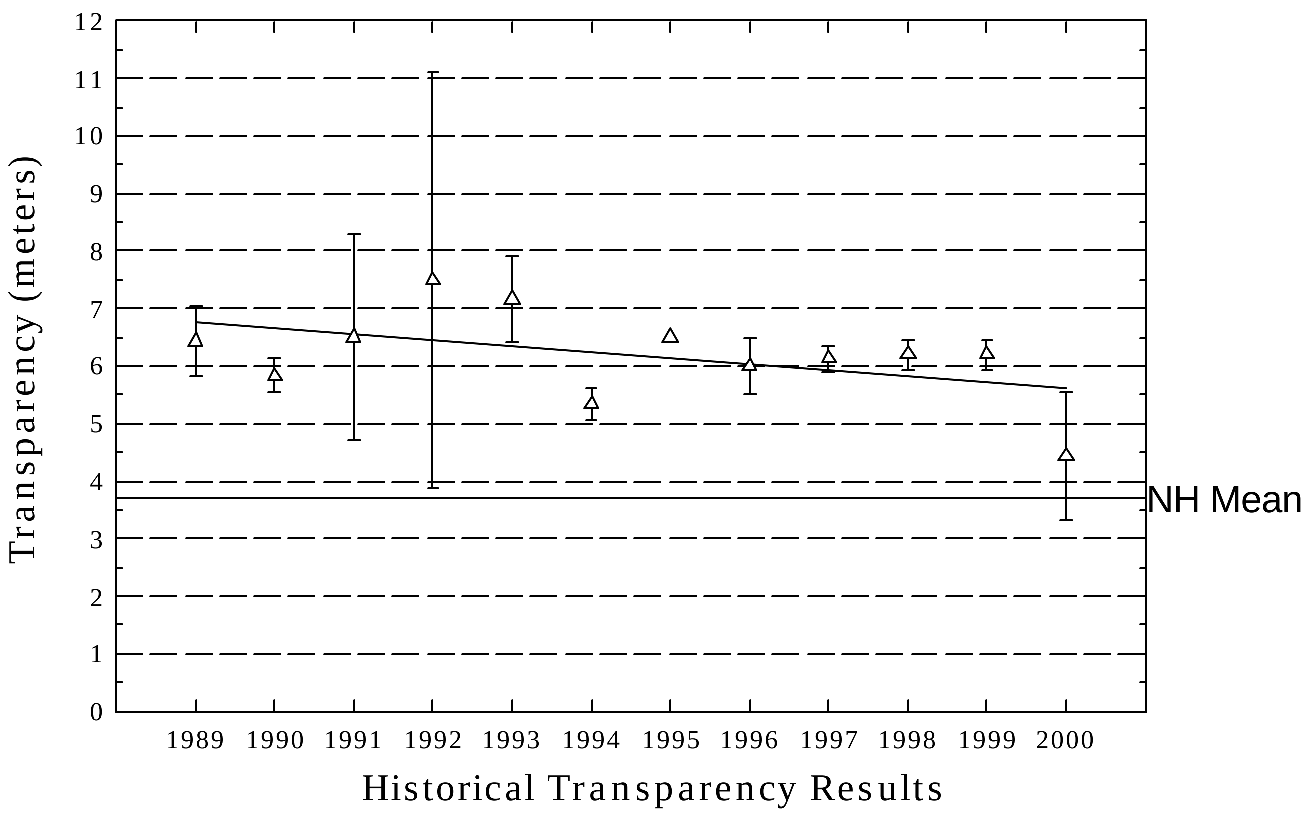


Historical Chlorophyll-a Results

Laurel Lake

Figure 2. Monthly and Historical Transparency Results





Laurel Lake

Figure 3. Monthly and Historical Total Phosphorus Data.

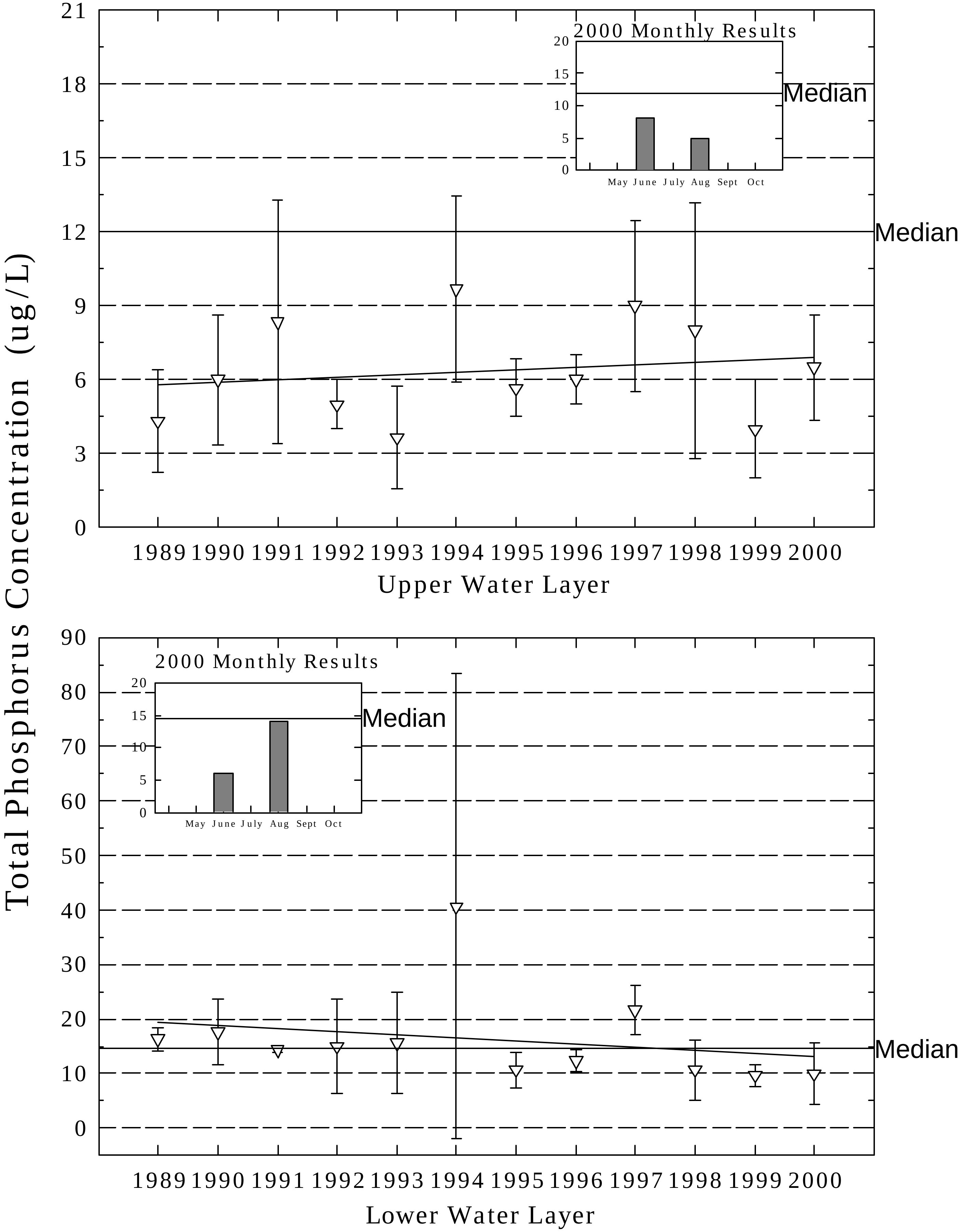


Table 1.

LAUREL LAKE

FITZWILLIAM

Chlorophyll-a results (mg/m^3) for current year and historical sampling periods.

Year	Minimum	Maximum	Mean
1989	2.37	12.15	7.71
1990	1.82	7.55	4.21
1991	2.72	3.85	3.34
1992	1.80	6.75	4.82
1993	1.82	12.91	6.54
1994	3.46	5.64	4.50
1995	0.73	3.79	2.29
1996	2.61	4.95	3.49
1997	1.99	3.65	2.60
1998	1.82	2.75	2.13
1999	2.39	5.10	4.07
2000	3.53	5.56	4.80

Table 2.

LAUREL LAKE

FITZWILLIAM

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06 / 28 / 1989	PERIDINIUM	13
	DINOBRYON	49
	CERATIUM	27
06 / 29 / 1990	DINOBRYON	43
	CHRYSOSPHAERELLA	22
06 / 28 / 1991	CHRYSOSPHAERELLA	75
	PERIDINIUM	13
	DINOBRYON	9
06 / 26 / 1992	ASTERIONELLA	41
	PERIDINIUM	13
	CHRYSOSPHAERELLA	11
07 / 29 / 1992	CHRYSOSPHAERELLA	97
06 / 23 / 1993	CHRYSOSPHAERELLA	52
06 / 27 / 1994	SYNURA	76
	TABELLARIA	13
06 / 19 / 1995	ANABAENA	89
	UROGLENOPSIS	4
	DINOBRYON	2
08 / 28 / 1995	DINOBRYON	82
	CHRYSOSPHAERELLA	12
	MICROCYSTIS	3
07 / 29 / 1996	CHRYSOSPHAERELLA	30
	DINOBRYON	24
	TABELLARIA	12
06 / 23 / 1997	RHIZOSOLENIA	70
	GYMNODINIUM	11
	CHRYSOSPHAERELLA	7

Table 2.

LAUREL LAKE

FITZWILLIAM

Phytoplankton species and relative percent abundance.

Summary for current and historical sampling seasons.

Date of Sample	Species Observed	Relative % Abundance
06 / 22 / 1998	SYNURA	32
	DINOBRYON	23
	MALLOMONAS	19
06 / 28 / 1999	STAURASTRUM	22
	CHRYSOSPHAERELLA	11
	RHIZOSOLENIA	10
06 / 26 / 2000	ASTERIONELLA	54
	UROGLENOPSIS	31
	TABELLARIA	4

Table 3.

LAUREL LAKE

FITZWILLIAM

Summary of current and historical Secchi Disk transparency results (in meters).

Year	Minimum	Maximum	Mean
1989	5.8	7.0	6.4
1990	5.5	6.0	5.8
1991	5.0	8.5	6.5
1992	4.5	11.5	6.7
1993	6.5	8.0	7.1
1994	5.0	5.5	5.3
1995	6.5	6.5	6.5
1996	5.5	6.5	6.0
1997	6.0	6.4	6.1
1998	6.0	6.5	6.2
1999	6.0	6.5	6.2
2000	3.3	5.5	4.4

Table 4.

LAUREL LAKE
FITZWILLIAM

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
388 EAST LAKE				
	2000	4.88	4.88	4.88
408 EAST LAKE				
	2000	4.37	4.37	4.37
CAMPGROUND #8				
	1989	6.51	6.51	6.51
EPILIMNION				
	1989	6.30	6.47	6.36
	1990	6.43	6.65	6.51
	1991	6.50	6.70	6.62
	1992	6.42	6.77	6.53
	1993	6.56	6.68	6.60
	1994	6.28	6.56	6.42
	1995	6.21	6.83	6.48
	1996	6.20	6.80	6.47
	1997	6.12	6.80	6.39
	1998	6.37	6.57	6.48
	1999	6.43	6.72	6.59
	2000	6.32	6.55	6.46
HYPOLIMNION				
	1989	5.74	5.94	5.85
	1990	5.95	6.00	5.97
	1991	5.80	5.82	5.81

Table 4.

LAUREL LAKE
FITZWILLIAM

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1992	5.84	6.05	5.91
	1993	5.86	5.93	5.88
	1994	5.74	5.80	5.77
	1995	5.95	6.21	6.06
	1996	5.85	5.95	5.90
	1997	5.85	6.00	5.94
	1998	5.74	5.79	5.77
	1999	5.87	6.10	5.94
	2000	5.64	6.02	5.82
INLET #1				
	1989	6.01	6.15	6.07
	1990	6.01	6.36	6.18
INLET #2				
	1989	6.05	6.25	6.14
METALIMNION				
	1989	6.00	6.48	6.11
	1990	6.34	7.16	6.54
	1991	6.40	6.62	6.50
	1992	6.30	6.76	6.45
	1993	6.12	6.51	6.26
	1994	5.89	6.38	6.12
	1995	6.28	6.67	6.38
	1996	6.10	6.41	6.24
	1997	6.25	6.50	6.36
	1998	6.10	6.30	6.22

Table 4.

LAUREL LAKE

FITZWILLIAM

pH summary for current and historical sampling seasons.
Values in units, listed by station and year.

Station	Year	Minimum	Maximum	Mean
	1999	6.21	6.72	6.34
	2000	6.28	6.48	6.34
NORTH BEACH INLET				
	2000	6.02	6.02	6.02
OUTLET				
	1989	5.89	5.89	5.89
	1990	5.84	6.00	5.93
ROMANO				
	1989	4.74	4.74	4.74
SO. END OUTLET #3				
	1989	5.86	5.86	5.86
TREAT OUTLET				
	1991	6.07	6.07	6.07
WHITE'S BEACH INLET				
	1989	5.82	5.82	5.82

Table 5.

LAUREL LAKE

FITZWILLIAM

Summary of current and historical Acid Neutralizing Capacity.
Values expressed in mg/L as CaCO .

Epilimnetic Values

Year	Minimum	Maximum	Mean
1989	1.60	1.80	1.70
1990	0.70	2.00	1.40
1991	1.60	3.40	2.27
1992	1.80	3.60	2.50
1993	2.20	3.10	2.65
1994	2.30	2.30	2.30
1995	2.20	2.80	2.50
1996	1.30	2.40	2.00
1997	0.40	2.60	1.73
1998	2.10	2.20	2.13
1999	2.20	2.70	2.47
2000	1.90	2.60	2.17

Table 6.

LAUREL LAKE
FITZWILLIAM

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
388 EAST LAKE				
	2000	53.6	53.6	53.6
408 EAST LAKE				
	2000	28.2	28.2	28.2
CAMPGROUND #8				
	1989	49.3	49.3	49.3
EPILIMNION				
	1989	48.7	48.8	48.7
	1990	48.4	48.7	48.6
	1991	47.7	49.0	48.2
	1992	45.2	47.5	46.6
	1993	47.9	48.3	48.1
	1994	49.7	50.5	50.2
	1995	48.7	49.4	49.1
	1996	49.0	49.1	49.0
	1997	43.9	45.4	44.5
	1998	44.7	46.6	45.7
	1999	48.6	49.2	48.8
	2000	46.5	51.7	48.6
HYPOLIMNION				
	1989	50.1	52.8	51.3
	1990	49.5	53.1	50.7
	1991	49.1	51.2	49.9
	1992	48.5	50.3	49.1
	1993	47.1	49.0	48.1

Table 6.

LAUREL LAKE
FITZWILLIAM

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
	1994	50.6	55.2	52.4
	1995	47.8	51.7	49.5
	1996	49.5	53.6	51.4
	1997	45.7	48.7	47.2
	1998	46.9	50.1	48.8
	1999	48.2	52.3	50.2
	2000	49.0	54.3	50.9
INLET #1				
	1989	40.6	46.6	43.6
	1990	32.1	45.8	37.3
INLET #2				
	1989	48.8	49.1	48.9
METALIMNION				
	1989	47.7	50.2	48.9
	1990	47.6	48.2	47.9
	1991	47.3	49.2	48.1
	1992	45.5	47.6	46.8
	1993	46.7	49.1	47.7
	1994	48.6	50.8	49.7
	1995	48.2	49.7	48.9
	1996	44.2	48.6	47.1
	1997	44.6	45.0	44.8
	1998	44.8	46.7	45.5
	1999	47.9	48.6	48.1
	2000	46.6	46.8	46.7

Table 6.

LAUREL LAKE
FITZWILLIAM

Specific conductance results from current and historic sampling seasons. Results in uMhos/cm.

Station	Year	Minimum	Maximum	Mean
NORTH BEACH INLET				
	2000	37.2	37.2	37.2
OUTLET				
	1989	48.2	48.2	48.2
	1990	48.6	49.0	48.7
ROMANO				
	1989	36.8	36.8	36.8
SO. END OUTLET #3				
	1989	48.7	48.7	48.7
TREAT OUTLET				
	1991	48.0	48.0	48.0
WHITE'S BEACH INLET				
	1989	34.4	34.4	34.4

Table 8.

LAUREL LAKE
FITZWILLIAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
CAMPGROUND #8				
	1989	3	19	11
EPILIMNION				
	1989	2	6	4
	1990	4	9	6
	1991	5	14	8
	1992	4	6	5
	1993	2	6	3
	1994	7	14	9
	1995	5	7	5
	1996	5	7	6
	1997	7	13	9
	1998	5	14	8
	1999	2	6	4
	2000	5	8	6
HYPOLIMNION				
	1989	14	18	16
	1990	12	24	17
	1991	14	15	14
	1992	9	25	13
	1993	8	26	15
	1994	16	90	40
	1995	7	13	10
	1996	10	14	12
	1997	19	27	21

Table 8.

LAUREL LAKE

FITZWILLIAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
	1998	7	17	10
	1999	8	12	9
	2000	6	14	10
INLET #1				
	1989	59	99	79
	1990	17	56	36
INLET #2				
	1989	6	8	7
METALIMNION				
	1989	8	9	8
	1990	8	79	31
	1991	7	9	8
	1992	5	10	7
	1993	3	11	8
	1994	7	14	9
	1995	6	9	7
	1996	8	11	10
	1997	8	13	10
	1998	6	37	18
	1999	2	7	3
	2000	6	9	7
OUTLET				
	1989	17	17	17
	1990	13	25	19

Table 8.

LAUREL LAKE

FITZWILLIAM

Summary historical and current sampling season Total Phosphorus data. Results in ug/L.

Station	Year	Minimum	Maximum	Mean
ROMANO				
	1989	14	14	14
SO. END OUTLET #3				
	1989	16	32	24
TREAT OUTLET				
	1991	19	19	19
WHITE'S BEACH INLET				
	1989	93	93	93

Table 9.

LAUREL LAKE
FITZWILLIAM

Current year dissolved oxygen and temperature data.

Depth (meters)	Temperature (celsius)	Dissolved Oxygen (mg/L)	Saturation (%)
	June 26, 2000		
0.1	22.8	8.1	93.9
1.0	22.3	8.1	93.1
2.0	22.2	8.1	93.2
3.0	21.9	8.2	93.2
4.0	20.3	8.4	93.1
5.0	17.8	8.8	92.3
6.0	13.9	7.8	75.7
7.0	12.2	7.0	65.2
8.0	10.9	5.6	50.3
9.0	10.6	4.9	44.2
10.0	10.4	4.5	40.5
11.0	10.2	4.1	36.1
12.0	10.1	3.7	33.3
13.0	10.0	3.0	26.5
14.0	10.0	2.7	23.7

Table 10.

LAUREL LAKE

FITZWILLIAM

Historic Hypolimnetic dissolved oxygen and temperature data.

Date	**Depth** (meters)	**Temperature** (celsius)	**Dissolved Oxygen** (mg/L)	**Saturation** (%)
June 28, 1989	15.0	9.0	2.1	18.0
June 29, 1990	12.0	10.0	1.7	15.0
June 28, 1991	13.0	11.8	0.4	3.7
June 26, 1992	14.0	8.5	0.2	1.7
July 29, 1992	11.0	11.0	0.4	4.0
June 23, 1993	14.0	9.3	3.1	27.0
June 27, 1994	13.0	9.5	0.5	5.0
June 19, 1995	11.5	11.5	1.1	10.0
June 24, 1996	12.0	9.7	1.8	15.0
June 23, 1997	13.0	11.1	2.1	19.0
June 22, 1998	13.0	10.1	1.7	15.0
June 28, 1999	11.0	11.5	1.9	17.2
June 26, 2000	14.0	10.0	2.7	23.7

Table 11.

LAUREL LAKE
FITZWILLIAM

Summary of current year and historic turbidity sampling.
Results in NTU's.

Station	Year	Minimum	Maximum	Mean
388 EAST LAKE				
	2000	0.4	0.4	0.4
408 EAST LAKE				
	2000	0.1	0.1	0.1
EPILIMNION				
	1997	0.2	0.3	0.2
	1998	0.1	0.3	0.2
	1999	0.2	0.2	0.2
	2000	0.1	0.3	0.2
HYPOLIMNION				
	1997	0.5	1.8	1.0
	1998	0.3	2.5	1.2
	1999	0.3	1.6	0.8
	2000	0.2	1.6	0.7
METALIMNION				
	1997	0.2	0.3	0.3
	1998	0.3	0.4	0.3
	1999	0.2	0.3	0.2
	2000	0.1	0.4	0.3
NORTH BEACH INLET				
	2000	0.4	0.4	0.4

Table 12.

LAUREL LAKE

FITZWILLIAM

Summary of current year bacteria sampling.
Results in counts per 100ml.

Location	Date	E. Coli See Note Below
388 EAST LAKE		
	July 5	38
408 EAST LAKE		
	July 5	23
NORTH BEACH		
	June 26	3
	July 5	32
	July 17	4
	August 21	1
SOUTH BEACH		
	June 26	0
	July 17	2
	August 21	6
SWIM CLUB		
	June 26	0
	July 17	1
	August 21	1

NOTE: "<" means "less than" and ">" means "greater than"